clc

clear all

close all

%My\_Data

month=[1 2 3 4 5 6 7 8 9 10 11 12] % 1-january, 2-february... 11-october, 12-december

temp=[16.6115 20.2522 23.3404 27.162 30.6121 29.1138 27.5206 27.0912 27.2284 25.9414 22.3532 18.6159]% 12 avg. temperatures corresponding to 12 months

%Plotting original signal with the data taken

figure(1) % First figure

plot(month,temp); %plotting the values of month and temp data on x-axis and y-axis respectively

title("Average Monthly Temperaure of India in 2015 ",'fontsize',16,'fontweight','bold')% giving the title name with fontsize as 16 & font weight as bold

xlabel("Month",'fontsize',16)% labelling x-axis as month with font size 16

ylabel("Average Temperature(Celcius)",'fontsize',16)%labelling y-axis as "Average Temperature(Celcius)" with font size 16

%Sampling the Data &plotting sampled signal

figure(2)%second figure

stem(month,temp)% for plotting sampled signal

title("Sampled Signal",'fontsize',16,'fontweight','bold')% giving the title name as"Sampled Signal" with fontsize as 16 & font weight as bold

xlabel("Month",'fontsize',16')% labelling x-axis as month with font size 16

ylabel("Average Temperature(Celcius)",'fontsize',16)%labelling y-axis as "Average Temperature(Celcius)" with font size 16

%Quantization of sampled data

n\_bit=4;% number of bits per sample i.e. 4

L=2^n\_bit;% 'L' denotes number of levels of quantization i.e 16

xmax=31;% max. value

xmin=17;% min. value

d=(xmax-xmin)/L; %'d' denotes quantization interval 1.e. ((31+17)/16=0.875)

partition=xmin:d:xmax; % partition is definition of decision lines i.e. 17 to 31 with interval 0.875

code=xmin-(d)/2:d:xmax+(d)/2;%definition of representation levels i.e. 16.5625 to 31.4375 with interval 0.875

[index,quants]=quantiz(temp,partition,code);%index here is quantization index and quantiz is inbuilt function used to quantize the signal by rounding off the values of the samples.

figure(3);%third figure

stem(quants);% for plotting quantized signal

title("Quantized Signal",'fontsize',16,'fontweight','bold');%giving the title name as "Quantized Signal" with fontsize as 16 & font weight as bold

xlabel("Month",'fontsize',16);%labelling x-axis as month with font size 16

ylabel("Average Temperature(Celcius)",'fontsize',16);%labelling y-axis as "Average Temperature(Celcius)" with font size 16

%Normalization

l1=length(index); % to convert 1 to n as 0 to n-1 indicies

for i=1:l1

if (index(i)~=0)

index(i)=index(i)-1;

end

end

l2=length(quants);

for i=1:l2 % for the convertion of end representation levels within the range.

if(quants(i)==xmin-(d/2))

quants(i)=xmin+(d/2);

end

if(quants(i)==xmax+(d/2))

quants(i)=xmax-(d/2);

end

end

% Encoding

code=de2bi(index,'left-msb'); % for the conversion of indices from decimal to binary

k=1;

for i=1:l1 % to convert column vector to row vector

for j=1:n\_bit

coded(k)=code(i,j);

j=j+1;

k=k+1;

end

i=i+1;

end

figure(4);%fourth figure

stairs(coded);

axis([0 60 -3 3]) % -3 &3 are the min and max coordinates of y-axis and 0 ,60 are the min and max values of x-axis

%plot of digital signal

title('Digital Signal','Fontsize',12,'Fontweight','bold');%giving the title name as "Digital Signal" with fontsize as 16 & font weight as bold

xlabel("Month",'fontsize',16);%labelling x-axis as month with font size 16

ylabel("Average Temperature(Celcius)",'fontsize',16);%labelling y-axis as "Average Temperature(Celcius)" with font size 16

%Demodulation

code1=reshape(coded,n\_bit,(length(coded)/n\_bit));

index1=bi2de(code1,'left-msb'); %converting from decimal to binary

resignal=d\*index+xmin+(d/2);

figure(5);%fifth figure i.e. plot of demodulated signal compared to original signl

subplot(2,1,1)%for plotting first figure i.e. demodulated signal

plot(resignal); %plotting demodulated signal

title('Demodulated Signal','fontsize',16,'fontweight','bold');%giving the title name as "Demodulated Signal" with fontsize as 16 & font weight as bold

xlabel("Month",'fontsize',16);%labelling x-axis as month with font size 16

ylabel("Average Temperature(Celcius)",'fontsize',16);%labelling y-axis as "Average Temperature(Celcius)" with font size 16

subplot(2,1,2) %for plotting second figure i.e. original signal

plot(month,temp);%plotting of original signal for comparision

title('Original Signal','fontsize',16,'fontweight','bold');%giving the title name as "Original Signal" with fontsize as 16 & font weight as bold

xlabel("Month",'fontsize',16);%labelling x-axis as month with font size 16

ylabel("Average Temperature(Celcius)",'fontsize',16);%labelling y-axis as "Average Temperature(Celcius)" with font size 16